Review of theoretical and empirical contributions on business intelligence for teaching use

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ABSTRACT

The study analyzed the theoretical and empirical contributions of business intelligence (BI) in organizations through a systematic review of 30 articles from Scopus, Scielo, and Redalyc. Findings reveal a growing interest in BI between 2021 and 2023, with a predominance of studies in Asia and Oceania. A quantitative approach and a descriptive level were identified, with most publications in English. Emerging trends include BI maturity, the use of Big Data and artificial intelligence, and the need for strategies, leadership, and training to optimize the implementation and utilization of BI in organizations.

Keywords: Business intelligence; Effectiveness; Competencies; Managerial; Cultural; Technical

Introduction

Nowadays, technological progress and hypercompetitiveness have driven the use of business information systems as key tools for decision making. Business intelligence (BI) has gained relevance in various sectors, standing out as a strategic process that facilitates competitive advantage through the analysis of data from multiple sources (Ain *et al.*, 2019). Its implementation not only improves productivity and profitability, but also contributes to the design of strategies based on an analytical vision (Khatibi *et al.*, 2020).

In this context, the need for an organizational culture focused on effective information management arises. A BI culture makes it possible to respond to knowledge demands and facilitates decision making in dynamic environments. Organizations must continuously record and analyze internal and external changes to anticipate their effects (Skyius and Valentukevice, 2020). To do so, BI adoption requires technical, cultural and managerial competencies, ensuring that strategic decisions are based on accurate and reliable information (Ahmad *et al.*, 2022). The absence of adequate data analytics can significantly affect organizational performance (Awawdeh *et al.*, 2022).

In addition, BI transforms uncertainty into competitive advantage by turning disruption into market opportunities through rapid and unified access to information (Elgendy, 2021). Its implementation is still in the development phase in many organizations, requiring proper planning based on business structure, culture, and strategies (Radenkovíc *et al.*, 2018). BI technology plays a key role in organizational agility by providing systematized information for decision making. For its success, it is critical for managers to possess management skills, organizational culture, and technical expertise (Atawah, 2018).

From this perspective, information is a strategic asset that drives the growth and competitiveness of companies. Its proper collection and processing allow transforming data into useful knowledge for decision making. This study focuses on analyzing the theoretical and empirical contributions of business intelligence (BI), highlighting its trends, applications and the importance of its correct implementation in different contexts (Venegas *et al.*, 2020).

Development

This research was carried out using the systematic review procedure, which involves describing qualitative and quantitative aspects of the different primary sources selected, which allows summarizing and interpreting the information on the topic addressed, in order to systematize and classify it, taking the research objective as a reference. It is considered that systematic reviews allow the elaboration of a critical synthesis based on scientific evidence that facilitates the answer to the research question. To achieve an in-

depth study, certain steps and scientific methodology must be followed to guarantee the information (Linares *et al.*, 2018). Three stages present in the search protocol planning, execution and results Kitchenham *et al.* (2009) are assumed for this study.

In the first stage based on planning, the search parameters were established, using for this study in Spanish the following combinations "inteligencia empresarial", "inteligencia AND empresa", "inteligencia AND organización", "Sistemas de soporte de decisión", in English "business intelligence", business AND intelligence" and 'Decision Support Systems'. The following databases were consulted in the preliminary review: Scopus, Scielo and Redalyc. In addition, inclusion criteria were established, in relation to the English and Spanish language, also of temporality considering from 2015 to 2023, giving priority to the most updated, in relation to the areas addressed were diverse, the information must be complete and important, as well as only reliable scientific articles. In relation to the exclusion criteria, we worked with duplicity, restricted access, incomplete information and articles that do not provide relevant information.

In the second stage, called execution, inclusion and exclusion criteria were applied in the search protocol, obtaining as preliminary results, Scopus (153), Redalyc (58) and Scielo (25) for a total of 236 articles.

In the results phase, a review was applied that included reading the abstract, introduction and conclusions, selecting from Scopus (21) articles, Redalyc (8) and Scielo (1) for a total of 30 scientific articles, the search and selection process is explained in Figure 1.

Source: Self elaboration

1.	Search words section

Español "inteligencia empresarial", ", inteligencia AND empresa", inteligencia AND organización", "Sistemas de soporte de decisión", in English "businessintelligence", business AND intelligence" and 'Decision Support Systems'

2. Search sources section

Scopus (153), Redalyc (58) and Scielo (25)
Total 236 articles

3. Application of criteria (items not directly related)

Scopus, Redalyc and Scielo (156 articles)

4. Application of criteria (articles with little relevant information)

Scopus, Redalyc and Scielo (106 articles)

5. Application of criteria (Duplicity)

Scopus, Redalyc and Scielo (66 articles)

6. Application of criteria (Complete)

7 Application of criteria (summary, introduction and conclusions)

Scopus, Redalyc and Scielo (60 articles)
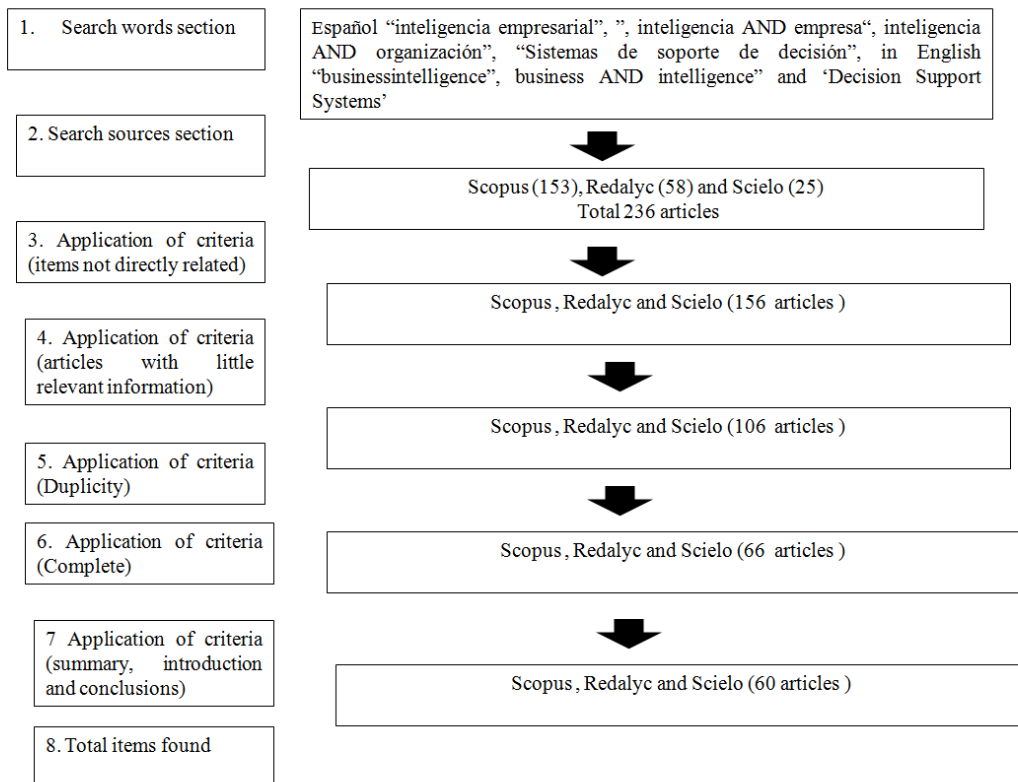
8. Total items found

Figure 1. Search protocol

In this part of the work, some significant aspects of the articles are mentioned, such as the year of publication, country of origin, number of articles per search engine. Figure 2 shows the prevalence of data with 33% in 2022, followed by 23% in 2023 and 13% in 2021.
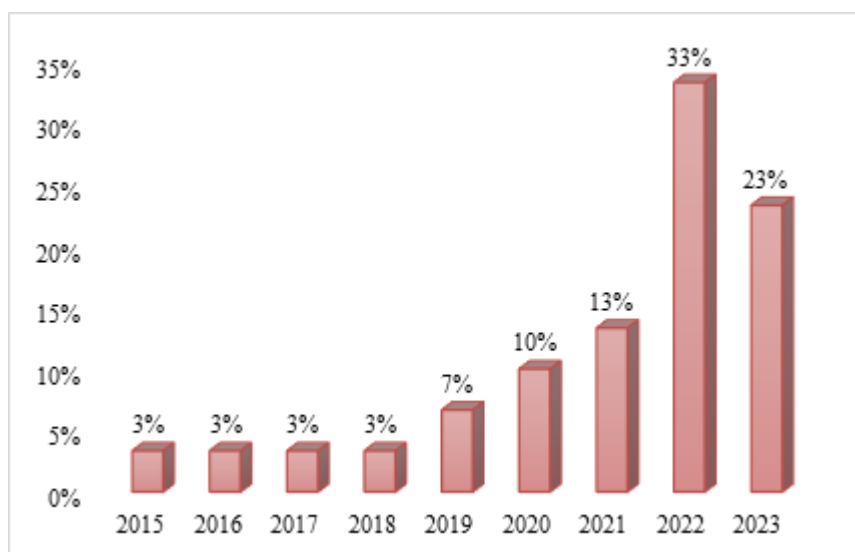
Source: Self elaboration

Figure 2. Articles by publication year

Figure 3 shows the organization of the articles according to country of origin, showing the prevalence of articles published in Jordan with 13%, Australia and Malaysia with 10% and 7% from Colombia, China, the United States, Italy and Lithuania.
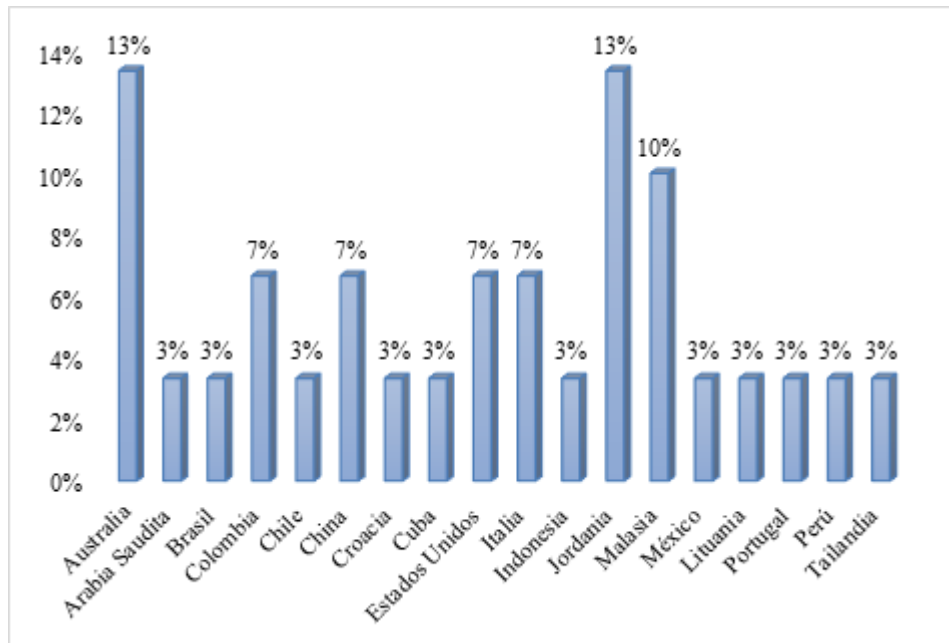
Source: Self elaboration

Figure 3. Articles published by country of origin

Figure 4, related to the methodological approach used in the different scientific articles, shows that 80% were quantitative and 20% qualitative. Highlighting that this topic is approached more from the quantitative approach.
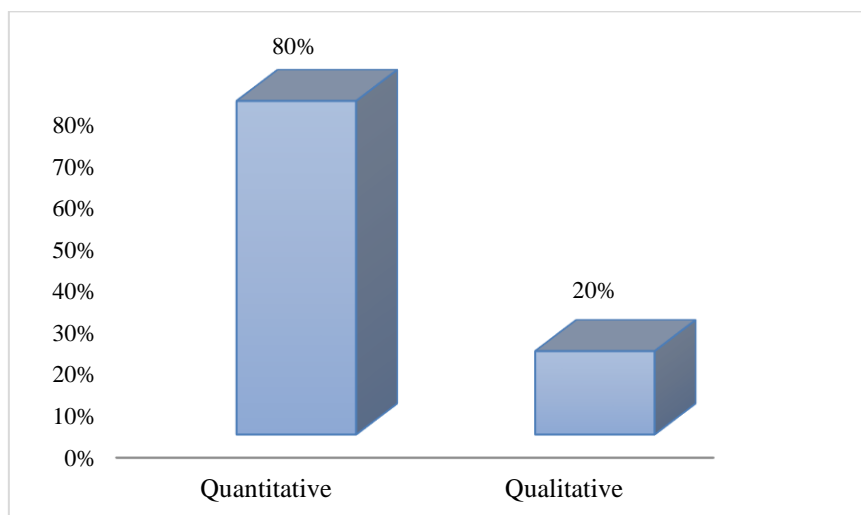
Source: Self elaboration

Figure 4. Methodological approach of the studies

Figure 5, referring to the level and type of research, shows that 47% corresponds to documentary and descriptive studies, only 3% to applied and correlational studies. These results allow us to understand that most of the studies carried out on the subject of business intelligence are oriented towards the documentary and descriptive field.
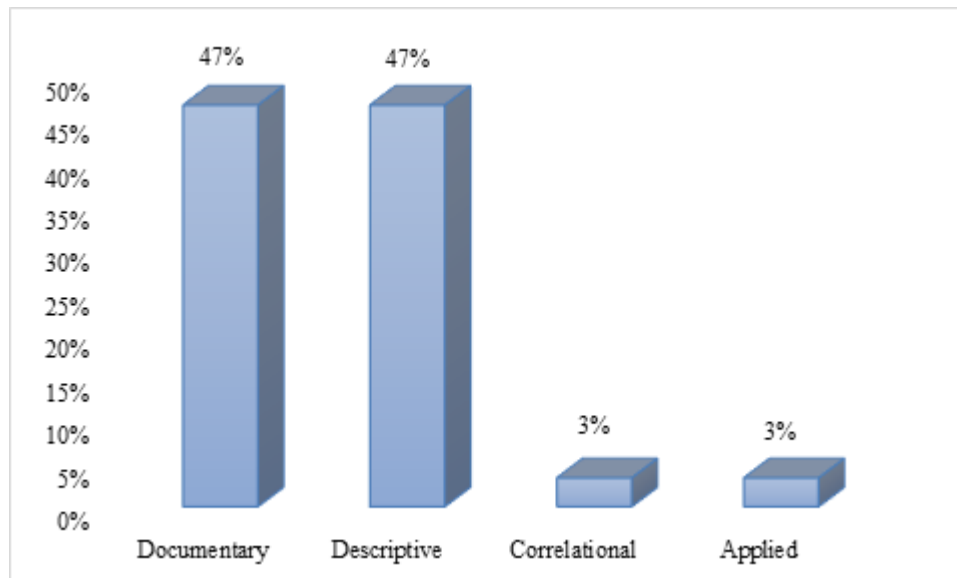
Source: Self elaboration

Figure 5. Level - type of research

Figure 6 shows the bibliometric analysis of trends related to business intelligence (BI) in different contexts. Using the VOS Viewer system with 1,563 articles related to business intelligence. Highlighting specific topics related to business intelligence such as business intelligence systems, information systems, big data, visualization, process efficiency and processing.

Source: Self elaboration

Figure 6. Cooccurrence network of BI with other areas

This analysis agrees with what has been pointed out in different researches, which make mention of significant aspects in the development of business intelligence, as well as maturity models, which guarantees the best implementation, also a methodological structuring guide is required as an element of improvements in BI maturity (Prieto *et al.*, 2015). In relation to the definitions used to define BI, two specific characteristics are mentioned one based on the collection, storage, analysis and delivery of available information. The second one based on the BI objective, which consists of the company's strategic decision making process (Boonsiritomachai *et al.*, 2016).

Also, some advantages in the use of BI and new innovations are mentioned, it implements the effectiveness of the company and allows permanent updating (Ali *et al.*, 2017). Patterns of BI use should also be established, based on theoretical and empirical bases for development, it was also evidenced that BI functional systems allow decision support, for which specific empirical support is required (Arnott *et al.*, 2017). BI enables the extension of competencies towards the achievement of organizational capabilities, providing better knowledge to control and employ BI systems. The efficiency of the employed systems and the ability to adapt should be evaluated (Atwah, 2018). BI is related to four basic elements referring to processes, people, governance and different capabilities. It was also pointed out that the implementation increase practicality and suitability, becomes a framework for business, improvement and performance (Yahaya *et al.*, 2019).

In this same context, it is pointed out as an advantage of the BI implementation, the ability in the information processes, because it allows to monitor the environment and detect important problems. Among the most relevant factors to generate the agility of the

company are the material and human factors, having as a starting point the planning, guidance and conduction of the discovery process (Skyrius & Valentukevice, 2020). Companies base their performance on internal information management, which is supported by information processing and technology, which is the first step in the full adoption of BI. In this sense, training in reference to the new technology must be increased (Mora, 2020). After applying BI, the efficiency to generate an adequate information analysis is increased, allowing the creation of new strategies, providing solutions to problems based on decision making (Varona *et al.*, 2021).

The company that applies BI requires innovative and trained personnel, which allows taking advantage of the systems, increasing performance and raising efficiency (Elbashiret *et al.*, 2021). Among the aspects most related to business intelligence is Big Data and how to manage intelligently. The BI application is reflected in customers, patient or users raising the quality of care (Janyapoon *et al.*, 2021). It is estimated that the empirical methodology is one of the most applied when addressing the issue of business intelligence (Baron *et al.*, 2021). It is important to highlight that leadership is present in the application and development of BI, which implies progressive skills to share information, analytical skills are also required, in cultural change and decision based on the achievement of the objective (Wee *et al.*, 2022).

BI in combination with Big Data contributes to improve at the level of decision making, i.e., decisions are made at the right time and reflected in performance (Al- Mlahmeh, 2022). In management processes, the adoption of digital technologies increases the amount of data available to make decisions in real time and in order to improve the quality of care (Basile *et al.*, 2022). It should be noted that BI capabilities are related to the company's ability to offer innovative, unique and meaningful products or services. It is also associated with the rapid generation of ideas (Alssad *et al.*, 2022). New companies require the implementation of BI systems, which allow them to increase their level of competitiveness and survival in the market, in addition to using technological tools and systems that provide them with internal and external information (Xu *et al.*, 2022).

Similarly, it is mentioned that specific competencies are required for BI implementation and data analysis, as well as the use of the appropriate strategy based on strategic planning (Malek & Alhawamdeh, 2022). Indeed, the use of BI allows addressing specific problems, giving them solutions from the understanding, sustained the information to build effective measures and address them (Freitas *et al.*, 2022). It should also be noted

that digital transformation, using Big Data analysis, artificial intelligence and business intelligence have positive effects on the development, improvement and digital transformation of the company (Admad & Mustafa, 2022).

The maturity of the BI model is done progressively based on the development and evaluation according to the needs, allowing to improve the understanding of the environment and increasing organizational development (Cardoso & Su, 2022). It should also be noted the impact of technologies in the digital transformation of companies, which make the processes, agile, flexible and effective, based on the production, collection of information (Llanes *et al.*, 2023). In addition, BI and competitiveness are related, also mentioning the need to expand the different BI approaches to increase knowledge. Additionally, it was observed that BI allows the creation of a theoretical and empirical framework to develop a consistent theory (Martínez & Rodríguez, 2023).

It should be noted that BI-based culture has a significant impact on technical competencies and management (Obidat *et al.*, 2023).

In relation to the quality of information and training, it can be said that these predict customer or user satisfaction, with data quality being a determining factor (Al-Okaily *et al.*, 2023). Similarly, the relationship of BI with company performance, the adoption of big data analytics was evidenced (Panic *et al.*, 2023). It is estimated that the use of AI allows contrasting different characteristics of the data, establishing anticipated projections of what would be demand, price and climate, as well as customer behavior before possible future purchases, highlighting that in BI improve customer relationships and allows analyzing strategies to make forecasts (Wang *et al.*, 2023). The new realities invite medium-sized companies to join the technical and methodological transformations, establishing new processes based on BI, requiring skills and strategies to take on this new challenge and increase the effectiveness of decision making (Fitrianingrum *et al.*, 2023).

Conclusions

By evidencing the theoretical and empirical contributions of trends in relation to business intelligence (BI) as an essential element in organizations in different contexts, it became evident that there is an increase in interest in researching business intelligence in recent

years, between 2021 and 2023. The largest number of publications was found in the continents of Asia and Oceania, which implies a greater research interest in relation to the topic. Quantitative approach prevailed, the type and level used for the scientific articles was documentary and descriptive, and the predominant language of the articles was English.

Likewise, new trends such as BI maturity are observed, the concept has also evolved establishing the use and purpose of BI, it is highlighted in some advantages focused on effectiveness, efficiency, efficacy and stimulation to create new ideas in the organizations that implement business intelligence. It imposes the need to create strategies, to focus on personnel training, not only in the management of new technology, but also of information, it highlights the establishment of leadership to improve the process of using and managing information. Likewise, the use of big data is mentioned as an essential element for the implementation of BI systems, and the use of AI is proposed as an alternative for the new technological era.